inway outcrop is, however, much the richer in fossils, of which the following have already been collected:

1. Crinoidal fragments in vast numbers.

2. Fragments of lamellibranchs, perhaps of the genus Lyrodesma.

3. Gasteropods of several genera and species. One of these is apparently a Holopea. Two or three other species which are very conspicuous on weathered surfaces have low spires and numerous whorls; some of these are from one to two inches in diameter, and have six or seven whorls. They look exceedingly like Ophileta, but may prove on careful examination to be Helicotoma or Pleurotomaria.

4. A single genal spine of a small trilobite.

There were found also, large calcareous plates, whose precise nature is not evident.

The general character of these organic remains indicates very decidedly the post-Cambrian origin of the strata; while, in spite of the Ophileta-like appearance of some of the Gasteropods, the presumption is strong that they belong to the Trenton epoch.

NOTE.—Subsequently to the presentation of the above paper, the continuation of these investigations at Canaan developed yet more important facts. In a limestone ledge on the Heminway farm, lying a little east of the fossiliferous outcrop above described, indications of Orthocerata were noticed; on following this outcrop northward a few hundred feet into the farm owned by Professor Charles Drown, quite a number of very interesting Orthocerata were discovered. These are finely preserved and distinctly characterized, showing admirably the septa and siphons. One of these is very nearly one foot long, and its shell is quite cylindrical, since the taper is exceedingly gentle. The septa in all are quite frequent, about fifteen to twenty to the inch. A well defined lituite was also found here.

These Orthoceratites are of the same general type as those occurring at Rockdale, near Poughkeepsie, N. Y., which from their character, and from their associate fossils, I consider as belonging to the horizon at present known as the Calciferous.

This, and the Trenton, therefore, appear to be associate components of the Canaan limestones.—*Wm. B. Dwight.*

MINERALOGY AND PETROGRAPHY.[1]

Volcanic Bombs.—In view of the fact that the volcanic bombs of Monte Somma present such a large variety of beautifully crystallized minerals in druses, and further, that in the case of the limestone bombs these minerals may well be supposed to owe their origin to the action of the hot lavas on pieces of limestone torn from the walls of the vent through which the lavas reached

[1] Edited by DR. W. S. BAYLEY, Madison, Wis.

the surface of the earth, it is a matter of no little surprise that sections of these bombs have not been more thoroughly investigated by means of the microscope and the other appliances now so generally made use of in the attempt to discover the origin of rocks and minerals. The most satisfactory article which has thus far appeared on this subject is that of Bruno Mierisch,[1] working under the supervision of Professor Zirkel at Leipzig. Eighty specimens of these bodies belonging to the collection of the University of Leipzig were examined. As might be expected, the results reached are exceedingly interesting. According to Mierisch the bombs may be divided into two great classes: (1) those consisting of broken pieces of older lavas, which are included in the younger lavas, and (2) the limestone or silicate bombs, in the druses of which the crystallized minerals, as mentioned above, are found. It is to the latter class that the present writer confines his attention. This class can be subdivided into limestone bombs and silicate bombs, and the latter of these again into (1) those in which the minerals are zonally arranged, and (2) those in which this arrangement is wanting. Under the microscope the limestone bombs are seen to consist of grains of calcite and an olivine mineral, which analysis proves to be forsterite, —the pure magnesium olivine. A noteworthy fact in this connection is the entire absence of even a trace of calcium in the forsterite, and the existence of the merest trace of magnesium in the closely-associated calcite. When druses occur in these limestone bombs their walls are formed of successive layers of magnesium mica (meroxene) and augite, upon the second of which the true druse minerals appear. With the increase in the size of the mica and augite zones the limestone bombs pass gradually into the zonally arranged silicate bombs, which consist of successive zones of olivine (mixed with a few grains of calcite and spinel), mica, and augite, upon the latter of which again the druse minerals proper are found. The second class of silicate bombs, to which belong the well-known sanidine bombs, is composed almost entirely of minerals found only in the druses of the limestone and zonal silicate bombs, and hence are probably merely druse fillings.

After treating in a general manner of the structure and classification of these bodies, Mierisch takes up separately each mineral occurring in them, and describes in detail its appearance, microscopical characteristics and associations. Here again we find many items of exceedingly interesting information, only the most important of which can be noticed. In the calcite of the limestone bombs glass inclusions were detected. These, according to the author, cannot be considered as secondary in origin, because not a trace of glass was detected in the ground-mass of any section examined. Consequently the calcite must have

[1] Tschermak's Min. u. Petrogr., Mitth. viii., 1886, p. 114.

included these in its crystallization from a molten magma. Porphyritic biotite crystals were seen to be surrounded by a rim of little augite crystals, evidently an alteration product, since in the immediate vicinity of the augite the biotite was bleached. In the olivine, fluid inclusions containing crystals of salt were detected. In some of the hauyne crystals inclusions of pyrrhotite were observed. It was noticed that as decomposition of these inclusions proceeded the substance of the hauyne became of a deeper blue color. The inference drawn by the author is to the effect that the sulphur freed by this decomposition is the agent which produces the blue coloration.[1]

Petrographical News.—About a year ago reference was made in these notes to the work of Hatch[2] on the andesites of Peru. The same author has continued his work, and now appears with a paper[3] on the rocks of the volcanoes in the neighborhood of Arequipa, a town in the southern part of Peru, about twenty miles from the Pacific coast. These rocks consist of andesites in all varieties, from the typical hornblende andesite, through intermediate varieties, to the rock containing augite as its only bisilicate constituent. Hypersthene occurs very widespread in the lavas of all the volcanoes in this region. Particular pains were taken to identify this mineral in a manner to preclude the possibility of error, and it was found that the only reliable means of distinguishing it from monoclinic augite consisted in the determination of the position of the optical axes. In almost every case where hornblende was present it was found to be surrounded by an opacitic rim, outside of which was occasionally seen a second rim of augite microlites. The high percentage of silica noticed in certain of the specimens was proven to be due to the silicification of the rock by the impregnation of its constituents by opal.——The Ponza Islands, off the west coast of Italy, are comprised[4] principally of trachytes, rhyolites, and tufas. An interesting point in connection with the trachyte of the island of Ponza is the occurrence of olivine in it. Glaucophane is supposed to occur in that of San Stefano. The tufas contain pebbles and pieces of quartz in addition to the broken crystals of various minerals. The ground-mass of the quartz trachyte from San Pietro,[5] off the southwest coast of Sardinia, consists of chalcedonic substance, in which are grouped little fibres of chalcedony in radial aggregates. Rhyolite, obsidian, and perlite are also found there.——In the diabase porphyrite from Petrosawodsk,[6] in Russia, about three hundred miles northeast of St. Petersburg, the porphyritic feldspar crystals are composed of parallel growths

[1] *Cf.* Vogelsang, Ueber natürliche Ultramarinverbindungen.
[2] American Naturalist, February, 1886, p. 161.
[3] Mineralog. u. Petrog., Mittheil. vii., 1886, p. 308.
[4] F. Eigel, ib., viii., 1886, p. 73. [5] Ib., p. 62. [6] C. v. Vogdt, ib., p. 101.

of oligoclase, labradorite, and orthoclase. These crystals, moreover, have undergone an unusual alteration into an aggregate of colorless prismatic needles of a uniaxial mineral, which occur either radially grouped or scattered indiscriminately in the mass of their otherwise apparently unaltered host. Their nature could not be determined, but an analysis showed that the alteration is attended with loss of silica and potassium and addition of aluminium. The ground-mass of the rock contains numerous little plagioclase crystals and grains of epidote, which v. Vogdt thinks were derived from the substance of the ground-mass by hydro-chemical processes.——Certain conglomeratic, granitic, and felsitic rocks occurring in Pembrokeshire, England, which Mr. Hicks[1] thinks are pre-Cambrian in age, have recently been described by Bonney.[2] The so-called felsites from Trefgarn are, according to this author, hälleflintas of volcanic origin, consisting of acid lavas and their associated ashes, which have been permeated by hot water, containing silica in solution, and have thus been silicified by the replacement of their feldspathic constituents by chalcedonic quartz.——The greenstones of St. Minver, Cornwall, have been separated by Rutley[3] into two distinct varieties. The first embraces those rocks which were once glassy basalts or andesites, but which have undergone decomposition with the production of bands and "small knots" of felsitic material, separated by bands of serpentine or palagonite. In the felsitic portion are small circular and lenticular areas of quartz and serpentine, which the author regards as the fillings of original vesicles. The second class described is of much fresher rocks. These contain large areas of augite, polarizing as a single individual, in which are included small crystals of plagioclase. [This same structure has been described frequently by American petrographers[4] under the term "lustre-mottling" (Pumpelly and Irving) and "poicilitic structure" (Williams).] Aggregates of augite, plagioclase, ilmenite, and a few accessory and secondary minerals make up the entire rock. The author calls it an augite-andesite.——In an appendix to an article by Mr. Durham[5] on the volcanic rocks of Fife, Professor Judd describes altered augite and enstatite andesites, in which the porphyritic pyroxene crystals occur in groups, and also porphyritic and perlitic mica-dacite glasses. In the base of the latter feldspar microlites and trichites are arranged in flowage lines. When heated before the blow-pipe a splinter of this rock lost 8.9 per cent. of its weight, and attained a bulk eight or ten times as great as that of the original fragment, producing a pumice which readily floated on water. The author concludes his paper with a dis-

[1] Quart. Jour. Geol. Soc., xlii., August, 1886, p. 351.
[2] Ib., xlii., August, 1886, p. 357. [3] Ib., xlii., August, 1886, p. 392.
[4] *Cf.* American Naturalist, March, 1886, p. 275.
[5] Quart. Jour. Geol. Soc., August, 1886, p. 418.

cussion of the several stages in the alteration of pyroxene andesites, as illustrated by the specimens examined. In the case of the mica-dacite glasses, alteration begins along the perlitic cracks, when it produces globiform masses, and then gradually extends outward until the entire body of the rock becomes white and opaque and appears to be isotropic. The author thinks that this alteration product may be a hydrated acid glass, corresponding to the palagonite of basic rocks.——In a recent article in which are given the results of the analyses of many of the phyllites and of the sericite, ottrelite, and hornblende schists of Belgium, Klement[1] says that the laterite from the Congo is a conglomerate consisting of sandstone pebbles cemented by limonite or some other hydrated oxide of iron.——In a letter to the *Neues Jahrbuch für Mineralogie*, Siemiradski[2] describes three anorthite rocks from the island of St. Thomas, one of the Antilles. One is a corsite with a ground-mass saturated with secondary opal, which has been produced by the decomposition of the other constituents. The other two are dyke rocks cutting the corsite. They can be best characterized as altered anorthite andesites.

Mineralogical News.—The optical investigations of Langemann[3] on harmotome, phillipsite, and stilbite seem to indicate that these three minerals are triclinic in crystallization instead of monoclinic as has heretofore been supposed. According to this view the twinning laws of these minerals are: (1) twinning planes $\infty P\breve{\infty}$ and OP, giving rise to interpenetration fourlings with an orthorhombic symmetry; (2) two fourlings twinned according to the plane $P\breve{\infty}$ produce eightlings, with a quadratic symmetry; and, finally (3), three eightlings with ∞P as their twinning plane yield twenty-fourlings with a regular symmetry.——By observing the forms of the figures which are produced on the cubic faces of sylvite, when it is exposed to the action of moist air, R. Brauns[4] has succeeded in showing that the crystallization of this mineral is like that of cuprite and salammoniac, in the gyroidal hemihedral division of the regular system. The bromide and the iodide of potassium crystallize similarly.——In a late number of the fourth Beilage Band of the *Neues Jahrbuch für Mineralogie* H. Schedtler[5] has an elaborate paper on the thermo-electrical relations of tourmaline. The paper opens with an historical introduction to the subject, in which the results of many earlier investigations are given. Then follow descriptions of the methods in use for the detection of electricity in minerals, and some general considerations, after which the author describes his own results based upon the examination of sixty-

[1] Min. u. Petrogr., Mitth. viii., 1886, p. 1.
[2] Neues Jahrb. f. Min., etc., 1886, ii. p. 175.
[3] Ib., p. 83. [4] Ib., vol. i. p. 224.
[5] Ib., Beil. Band iv., 1886, p. 519.

seven crystals, from almost every known locality in which this mineral is found. These results are embraced under fifteen heads. Under one of these he states that the electrical activity is greater in the green, brown, and red crystals than it is in black or colorless ones; and that the black crystals often show no electrical phenomena, but, on the other hand, are conductors of electricity. ——The same subject has been treated in a paper by E. Riecke in the *Annalen der Physik und Chemie.*[1]——In his study of Brazilian topaz K. Mack[2] has found that the electrical axis does not correspond to any crystallographic axis, and that in cases where the crystallographic axis does not exactly bisect the optical angle, this anomaly is accompanied by abnormal extinctions in the plane of the optical axes.

BOTANY.[3]

The Study of Plant Diseases.—Although the fungi themselves have been studied in this country for many years, the diseases they produce have hitherto received little attention. One would have supposed that from the thirty or forty agricultural colleges and agricultural departments of colleges in the United States something might have come, but the returns from these institutions have been as meagre as from other sources. Doubtless one great reason for this barrenness of results has been the want of time on the part of the professors of botany. With the burden of many classes always upon them, and often the almost total absence of collections, books, and instruments, the professor of "science" has had indeed a hard road, and it is a cruelty to blame him for not being productive. But with these allowances, it must be confessed that botany is often taught by men almost wholly unacquainted with the subject. It is by no means an unusual thing to find professors teaching botany whose knowledge of the subject stops short of the ability to handle the Compositæ. The Grasses and Sedges, to them, are little better than "Cryptogams," and as to the latter, they are simply Cryptogams. From such botanists no study of plant diseases need be expected.

Two recent publications ought to direct the attention of our botanists to this much-neglected field. Mr. Arthur's report, as botanist of the Agricultural Experiment Station at Geneva, N. Y., shows where and how good work may be done by those competent to do it. Among the topics taken up are Pear Blight, Rotting of Tomatoes, Mildew of Strawberries, Plum-leaf Fungus. Aside from its economic value, the report is valuable as indicating better methods of work in botany. Let any one read over the pages treating of the Pear Blight, and he cannot help feeling that the work there recorded is of a much higher order than that

[1] No. 5, 1886, p. 43. [2] Annalen der Physik und Chemie, No. 6, 1886, p. 153.
[3] Edited by Prof. CHARLES E. BESSEY, Lincoln, Nebraska.